



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/666,523	09/22/2003	Luc Wolff	PET-2102	5857

23599 7590 07/25/2006

MILLEN, WHITE, ZELANO & BRANIGAN, P.C.  
2200 CLARENDON BLVD.  
SUITE 1400  
ARLINGTON, VA 22201

EXAMINER

SINGH, PREM C

ART UNIT PAPER NUMBER

1764

DATE MAILED: 07/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/666,523

Applicant(s)

WOLFF ET AL.

Examiner

Prem C. Singh

Art Unit

1764

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

*continues to*

A SHORTENED STATUTORY PERIOD FOR REPLY IS ~~SET TO EXPIRE~~ CONTINUES TO MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION. *action dated 7/25/2006*

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 24 July 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 21-40 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 21-40 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 July 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
- 1) ☒ Certified copies of the priority documents have been received.
  - 2) ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - 3) ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Response to Amendment*

Cancellation of claims 1-20 and addition of new claims 21-40 is noted.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation

Art Unit: 1764

under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 21-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Magne-Drisch et al (US Patent 6,369,287) in view of Lee (US Patent 3,306,942).

Magne-Drisch invention discloses that the production and separation of p-xylene are carried out in industrial practice by arranging the following in a loop:

(a) process for separation of p-xylene by adsorption, whose effluents are p-xylene, on the other hand, and an aromatic C8 fraction that is substantially free of p-xylene, on the other hand. Crystallization can be combined with the adsorption stage to obtain p-xylene that is more pure (Column 1, lines 13-22). The second class of isomerization processes is known under the name of dealkylating isomerization. In this type of isomerization, ethylbenzene is converted into benzene and ethylene on catalysts with a ZSM-5 zeolite base, while the xylenes are brought into thermodynamic equilibrium. Hydrogen is also needed here to hydrogenate into ethane the ethylene that is formed (to prevent re-alkylation) and to prevent the coking of the catalyst (Column 1, lines 60-67). In industrial practice, ethyl benzene is the reaction intermediate product that makes it possible to obtain styrene by dehydrogenation (Column 2, lines 8-10). The

Art Unit: 1764

ethyl benzene production line is generally integrated into a plant for producing styrene and polystyrene (Column 2, lines 35-37).

Magne-Drisch invention further discloses a feedstock that is provided via a supply line (1) and comprises a mixture of p-xylene, o-xylene, m-xylene, and ethyl benzene is introduced into a first adsorption unit (2). This unit comprises chromatographic columns that are filled with an adsorbent, a Ba-X zeolite, for example, and it operates according to the principle of a simulated counter-current moving bed. Said unit comprises four chromatographic zones. A raffinate that consists essentially of o-xylene and m-xylene and ethyl benzene and desorbent is recovered via a line (3). The desorbent which is toluene that is introduced via a line (6a) makes it possible to desorb via a line (4) an extract that consists of essentially pure p-xylene and toluene that is distilled and recycled (not shown in the Figure) (Column 5, lines 9-22). The raffinate is sent via line (3) into a distillation column (5) which feeds a toluene distillate via a line (6) that is optionally recycled and a residue. The latter is introduced via a line (7) into a second adsorption unit (8) that operates as first unit (2), according to the principle of the simulated countercurrent moving bed. Said smaller second unit comprises columns that are filled with an adsorbent that contains, for example, titanosilicate. The unit comprises four main chromatographic zones. A raffinate that contains desorbent and m-xylene and o-xylene is drawn off via line (10) while an extract that contains basically essentially pure ethyl benzene and desorbent is desorbed by the toluene that is introduced via a line (12 a). This draw-off is carried out via a line (9) downstream from the line for introducing desorbent into unit (8) (Column 5, lines 23-37). The raffinate is sent into a

Art Unit: 1764

distillation column (11) that feeds a toluene distillate via a line (12) and a residue of o-xylene and m-xylene via a line (13). At least a portion of this residue can be introduced into a distillation unit (18) via a line (17). Said unit (18) makes it possible to recover an essentially pure m-xylene distillate via a line (19) and an essentially pure o-xylene residue via a line (20). The other portion of the residue is sent into an isomerization unit that operates with or without hydrogen that is introduced via a line (15). The isomerate that is collected via a p-xylene-enriched line (16) essentially contains no ethyl benzene and is mixed at line (1) (Column 5, lines 39-54). Also, preferably by a standard method that is not shown in the figure, at least some of C<sub>9</sub>+ compounds are eliminated from the isomerate (Column 5, lines 56-59).

Magne-Drisch invention also discloses that in the first adsorption unit, it is advantageous to establish five chromatographic zones instead of four, as indicated above (Column 5, lines 60-62). The first simulated countercurrent moving bed adsorption, which makes it possible to extract p-xylene, takes place under the following conditions:

Temperature: 160°C

Number of beds: 24

Minimum pressure: 9 bar

Toluene/feedstock ratio = 1.6:1 (Column 7, lines 55-65).

The second simulated countercurrent moving bed adsorption that makes it possible to extract ethyl benzene takes place under the following conditions:

Temperature: 160°C

Art Unit: 1764

Number of beds: 18

Minimum pressure: 9 bar

Toluene/feedstock ratio = 1.6:1 (Column 8, lines 16-24).

Magne-Drisch invention discloses that the ethyl benzene production line is generally integrated into a plant for producing styrene, but it does not disclose dehydrogenation step of ethyl benzene to styrene.

Lee invention discloses an improved process for the dehydrogenation of alkyl aromatic hydrocarbons such as ethylbenzene to vinyl aromatic hydrocarbons such as styrene and to an improved iron oxide catalyst therefor (Column 1, lines 9-12).

It would have been obvious to one skilled in the art at the time the invention was made to combine the inventions of Magne-Drisch and Lee and introduce a dehydrogenation step in the process scheme of Magne-Drisch and take the stream (9) consisting of 99% pure ethylbenzene (Column 8, line 26) and convert it to styrene to make the process more profitable and useful due to numerous applications of styrene.

Magne-Drisch invention does not disclose that the stream (23 b) contains styrene which is hydrogenated and the effluent conveyed to the isomerization zone.

As mentioned earlier, by combining Magne-Drisch and Lee inventions, the dehydrogenation effluents will be taken to a distillation column to separate styrene and unconverted ethylbenzene to get pure styrene. The bottoms will consist of small quantity of styrene and unconverted ethylbenzene. As mentioned earlier, one skilled in the art will take the bottoms to a hydrogenation unit to prevent coking.

***Response to Arguments***

The Applicant argues that the claimed process does not obtain a pure ethylbenzene from the simulated moving bed, but instead a distilled raffinate which is a mixed intermediate product containing orthoxylene and metaxylene as well as ethylbenzene. It is this intermediate product which is then subjected to dehydrogenation in order to produce styrene, and then the styrene is recovered in a series of separation steps. Consequently, the concept of the present invention is significantly and unobviously different from the system set forth in the Magne-Drisch et al. reference.

The Applicant's argument is not persuasive because Magne-Drisch is producing 99% pure ethylbenzene. The process for converting ethylbenzene to styrene is conducted in the modified Magne-Drisch process as suggested by Lee invention. It would have been obvious to one skilled in the art to modify Magne-Drisch invention and use stream (9) for dehydrogenation to get pure styrene and avoid any further separation steps. Alternatively, one skilled in the art could use stream (3) in a dehydrogenation step to produce styrene and purify in an adsorption/distillation train.

The Applicant argues that the claimed recycle of stream (23b) to the first adsorption stage after an isomerization step is not found in the reference.

The Applicant's argument is not persuasive because Magne-Drisch discloses a similar recycle stream (13) going to the isomerization unit (14) and then to the first adsorption stage (2).



***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of Office action dated: July 25, 2006. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Prem C. Singh whose telephone number is 571-272-6381. The examiner can normally be reached on MF 6:30 AM-3:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1764

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ps/081606



Glenn Caldarola  
Supervisory Patent Examiner  
Technology Center 1764